to 0.5 V, which was 1/10 of the output voltage. When the iontophoresis apparatus incorporating the aforementioned iontophoresis device was used, each of the positive and negative electrodes applied to the skin had an area of 5 $cm^2$.

(Example 3)

A device for iontophoresis incorporates a detecting circuit for a residual voltage as shown in FIG. 5, in which the output voltage of the output circuit 19 was adjusted to a DC voltage of 5 V, and the analog switch 20 was closed to direct 5 V to the output terminal 21 and then the analog switch 20 was opened. The detection conditions were as follows. The voltage-adjusting fixed resistor 26 was 10 kΩ. The voltage-adjusting fixed resistor 27 was 90 kΩ. The threshold level of the voltage comparator 25 was 4.5 V, which was 9/10 of the output voltage. When the iontophoresis apparatus incorporating the aforementioned iontophoresis device was used, each of the positive and negative electrodes applied to skin had an area of 5 $cm^2$.

(Comparison 1)

A device for iontophoresis incorporates a detecting circuit for an output current as shown in FIG. 2. The detecting circuit for the output current comprises a negative-electrode side output terminal 7A, a current-detecting fixed resistor 8A, a circuit ground 9A, and a voltage comparator 10A as shown in FIG. 2, obtaining an output signal 11A from the voltage comparator 10A. In this embodiment, a DC voltage was used as the output voltage that was variable from 0 V to 10 V in

increments of 2V. The detection conditions were as follows. The current-detecting fixed resistor 8A was 1 kΩ and the threshold level of the voltage comparator 10A was 0.1 V. When the iontophoresis apparatus incorporating the aforementioned iontophoresis device was used, each of the positive and negative electrodes applied to the skin had an area of 5 $cm^2$.

(Test 1)

For Example 1 and Comparison 1, Table 1 lists the input voltages to the voltage comparators 10A and 10B and the output signals 11A and 11B with different values of the output voltage.

Table 1

| Output voltage (V) | Example 1 | | Comparison 1 | |
|---|---|---|---|---|
| | Input voltage (V) | Detection of conduction | Input voltage (V) | Detection of conduction |
| 0 | 0 | × | 0 | × |
| 2 | 0.19 | ○ | 0 | × |
| 4 | 0.43 | ○ | 0 | × |
| 6 | 0.69 | ○ | 0 | × |
| 8 | 0.97 | ○ | 0.03 | × |
| 10 | 1.24 | ○ | 0.12 | ○ |

If the output signal (detection of conduction) is "H" (indicated by ○), then it is determined that conduction is normal. If the output signal is "L" (indicated by ×), then it is determined that conduction is abnormal. As shown in Table 1, in Example 1, conduction was observed at an output voltage equal to or higher than 2 V. In contrast to this, in Comparison 1, conduction was observed only at an output voltage of 10 V. This indicates that the circuit according

to Example 1 has higher detection accuracy than Comparison 1.

(Test 2)

In Example 2, a detachment test was conducted with 3 subjects to determine whether the device was detached from the applied part of the transdermal. The result is as follows.

Table 2

| Area of the applied part | Subject 1 | | Subject 2 | | Subject 3 | |
|---|---|---|---|---|---|---|
| | Voltage (V) | Detection of detachment | Voltage (V) | Detection of detachment | Voltage (V) | Detection of detachment |
| 0/10 | 0 | L | 0 | L | 0 | L |
| 2/10 | 0.17 | L | 0.17 | L | 0.18 | L |
| 4/10 | 0.29 | L | 0.30 | L | 0.31 | L |
| 6/10 | 0.39 | L | 0.40 | L | 0.41 | L |
| 8/10 | 0.47 | L | 0.48 | L | 0.48 | L |
| 10/10 | 0.53 | H | 0.55 | H | 0.56 | H |

The test was conducted in such a way that the output voltage was 5 V, and the device was peeled off the transdermal slowly so that the area of the device in contact with the applied part of the transdermal varies from 0/10 to 10/10. For different sizes of the applied area, the input voltage and output signal 11B (detection of detachment) of the voltage comparator 10B were measured. "L" of the output signal 11B indicates that conduction was abnormal and "H" indicates that conduction was normal. From Table 2, the iontophoresis device according to Example 2 can detect detachment of the device encountered, even a small area, during the application.

(Example 3)

In Example 3, a detachment test was conducted in the same